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PTO 2772

Case Docket No. PHN 17,327

THE COMMISSIONER OF PATENTS AND TRADEMARKS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor(s):

Joseph W. Triepels, Roel H.L. Kusters, Fransiscus G.C. Verweg,  
Henri S.A.Handels, Marcel S.B. Bachus, Johannes W.J.M. Scheuermann

For: Display Device

**ENCLOSED ARE:**

- ☒ Associate Power of Attorney;  
☒ Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;  
☒ Preliminary Amendment;  
☒ Specification (10 Pages of Specification, Claims, & Abstract);  
☒ Declaration and Power of Attorney:  
 (2 Pages of a ☐ fully executed ☒ unsigned Declaration);  
☒ Drawing (2 sheets of ☐ informal ☒ formal sheets);  
☒ Certified copy of **Europe** application Serial No. **99200696.5**;  
☒ Other: Authorization Pursuant to 37 C.F.R. 1.136;  
☐ Assignment to

**FEE COMPUTATION**

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - 760.00
Total Claims	10 - 20 =	0	X \$18 =	0.00
Independent Claims	1 - 3 =	0	X \$78 =	0.00
Multiple Dependent Claims, if any			\$260 =	0.00
TOTAL FILING FEE . . . . .				\$760.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

☐ Amend the specification by inserting before the first line the sentence: --This is a continuation-in-part of application Serial No. , filed .--.

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Date of Deposit MARCH 6, 2000  
 I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

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 03/06/00

003030-24304560

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

Triepels et al.

PHN 17,327

Serial No.

Filed: Concurrently

Title: Display Device

Commissioner of Patents and Trademarks  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination, please amend the above-identified application as follows:

In the Specification

Page 1,	above line 1,	insert as a centered heading:
		BACKGROUND OF THE INVENTION--;
	above line 23,	insert as a centered heading:
		--SUMMARY OF THE INVENTION--;
	lines 23-24,	delete "of the type described
		above";
	line 26,	delete "the invention is
		characterized in that";
Page 2,	line 13,	change ", for example, USP" to
		--U.S. Patent No. -- change "but"
		to --and-- and delete "as";
	line 14,	change "USP" to --U.S. Patent No.--
		and delete "are possible";

line 34, change "Such an embodiment is  
characterized in that" to --Here--;  
Page 3, line 7, change "Such a display device is  
characterized in that" to --Here--;  
line 14, delete "In the drawings:" and insert  
as a centered heading:  
--BRIEF DESCRIPTION OF THE DRAWINGS--;  
line 24, insert as a centered heading:  
--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--;  
Page 4, line 17, change "As stated in the preamble,  
there" to --There--;  
Page 5, line 7, change "13" to --14--.

### In The Claims

1. (Amended) A display device comprising a first substrate having a conductor pattern for connecting pixels in an electrically conducting manner, [parts of which are connected in an electrically conducting manner to connection] and electrically conducting connections between the pattern and conducting tracks on a support, [characterized in that the] at least one said conducting connection [between at least a part of the conductor pattern and a connection track comprises] comprising a metal-metal contact, in which each metal of the metal-metal contact is chosen from the group of gold, silver and nickel.

4. (Amended) A display device as claimed in claim 1,  
[characterized in that the] wherein at least one said conducting  
connection [between at least a part of the conductor pattern and a  
connection track] comprises a resilient conductor.

Claim 5, line 2, delete "the part of".

6. (Amended) A display device as claimed in claim 1,  
[characterized in that] wherein the conductor pattern [is present on  
the support-facing side of] on the first substrate faces the  
support.

7. (Amended) A display device as claimed in claim 1,  
[characterized in that conductors associated with] wherein the  
conductor pattern comprises conductors which extend [as far as  
proximate] to an edge of the first substrate, [a conductor part  
associated with] the electrically conducting connection [between the  
connection track and the part of the conductor pattern enclosing the  
edge at the area of] comprising a conducting part which encloses  
said edge.

8. (Amended) A display device as claimed in claim 1, characterized  
in that the display device comprises a second substrate opposite  
from part of the first substrate and an electro-optical material  
between the two substrates, each being provided with [picture]  
substrate electrodes which define pixels with the [interpositioned]  
electro-optical material, the first substrate being provided with

the conductor pattern beyond the part of the first substrate located opposite the second substrate.

Claim 10, line 2, change "connection" to --conducting--.

In The Abstract


Page 10, last line, delete "Fig. 1".

Remarks

The specification and claims have been amended to correct informalities in language and grammar and to add headings in accordance with MPEP Section 601.

The above amendments are submitted to place this application in proper U.S. format. Entry of the amendment and an early action on the merits are solicited.

Respectfully submitted,

By   
F. Brice Faller, Reg. No. 29,532  
Attorney  
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## Display device

The invention relates to a display device comprising a first substrate having a conductor pattern for connecting pixels in an electrically conducting manner, parts of which are connected in an electrically conducting manner to connection tracks on a support. A conductor pattern may be understood to be both a pattern of exclusively column and row  
5 conductors and a more extensive pattern in which drive ICs are incorporated.

Display devices of this type, particularly liquid crystal display devices, are used very generally in, for example, measuring apparatus, but also in, for example, portable telephones. Moreover, electroluminescent display devices, based on (organic) LEDs find an increasingly wider application.  
10

With the ever increasing miniaturization of electronics, it is possible to realize an ever increasing number of drive electronics on the substrate. However, there is also a tendency to manufacture the actual display panel (display section) as a standard component. If  
15 such a standard component is mounted in an apparatus, for example, by soldering on the support (for example, a printed circuit board or another type of substrate provided with conducting (connection) tracks), or by clamping, stringent requirements are imposed on the contacts (low resistance, mechanical stability, etc.). To this end, contact paste is often used between the conductor pattern and further contact elements, such as connectors in connector  
20 housings, contact pins, etc. In addition, notably the tolerances of connection tracks to be connected on the support may become very strict with respect to the associated parts of the conductor pattern.

It is, inter alia, an object of the invention to provide a display device of the type described above in which connection conductors on the surface area of the first substrate are  
25 connected in a reliable manner to connection tracks on the support.

To this end, the invention is characterized in that the conducting connection between at least a part of the conductor pattern and a connection track comprises a metal-metal contact, in which each metal of the metal-metal contact is chosen from the group of gold,

silver and nickel. Since these metals are not attacked or are hardly attacked or oxidized, a pressure contact is sufficient in the final assembly.

The metal-metal contact is preferably a gold-gold contact.

A first embodiment of a display device according to the invention is  
5 characterized in that the conducting connection between at least a part of the conductor pattern and a connection track comprises a resilient conductor.

Since a satisfactorily conducting material (for example, gold) is chosen for the resilient conductor, the resistance of the contact between the conductor pattern and the connection track is negligible.

10 In this connection, a resilient conductor is understood to be any conductor in which, by compression of the conductor between two conducting faces, an electrically conducting contact between the two faces is obtained or maintained. Examples are so-called pogopins as described in, for example, USP 5,157,325 and JP-A-4-22077, but also the pins as described in USP 5,500,606 are possible. A possible conducting paste between the resilient  
15 conductor and the conductor track, which is cured by UV radiation, can now be dispensed with. This reduces the number of mounting steps (providing the paste, curing) for the end user (or the final assembly) where only mechanical handling is preferably performed.

A further embodiment of a display device according to the invention is characterized in that the conducting connection between the resilient conductor and the part of  
20 the conductor pattern comprises an anisotropically conducting foil.

This embodiment has the advantage that the foil can extend across the first substrate as far as, for example, the contacts of (drive) ICs. The conductance between the contact and the connection of the IC now takes place via the conductor of the foil (for example, copper tracks) so that a more low-ohmic connection is realized.

25 The invention is notably suitable for a display device in which the conductor pattern is present on the support-facing side of the first substrate.

The conductor pattern may be alternatively present on the other side of the substrate. Such a display device is characterized in that conductors associated with the conductor pattern extend as far as proximate to an edge of the first substrate, a conductor part  
30 associated with the electrically conducting connection between the connection track and the part of the conductor pattern enclosing the edge at the area of said edge.

The invention is applicable to display devices based on liquid crystal effects or other electro-optical effects, in which an electro-optical material is present between two substrates. Such an embodiment is characterized in that the display device comprises a second

substrate and an electro-optical material between the two substrates, each being provided with picture electrodes which define pixels with the interpositioned electro-optical material, the first substrate being provided with the conductor pattern beyond the part of the first substrate located opposite the second substrate. The display device may also be based on an  
5 electroluminescent effect.

The resilient conductor may alternatively contact the support on the side remote from the first substrate. Such a display device is characterized in that at least one resilient conductor contacts a conductor pattern on the side of the support remote from the first substrate.

10 These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiment(s) described hereinafter.

In the drawings:

15 Fig. 1 is a diagrammatic cross-section of a part of a first embodiment of a display device according to the invention,

Fig. 2 is a diagrammatic cross-section taken on the line II-II in Fig. 1,

Fig. 3 shows a variant of the connection shown in Fig. 2, while

20 Fig. 4 is a diagrammatic cross-section of a part of a second embodiment of a display device according to the invention.

The Figures are diagrammatic and not drawn to scale; corresponding parts generally have the same reference numerals.

25 Fig. 1 is a diagrammatic cross-section of a part of a display device, in this embodiment a liquid crystal display device, comprising a liquid crystal cell 1 having, in this embodiment, a twisted nematic liquid crystal material 2 which is present between two transparent substrates 3, 4 of, for example, glass, provided with electrodes 5, 6. The device further comprises polarizers (not shown) whose direction of polarization is, for example,  
30 mutually perpendicularly crossed. The device also comprises orientation layers (not shown) which orient the liquid crystal material on the inner walls of the substrates, in this embodiment in such a way that the cell has a twist angle of 90 degrees. In this case, the liquid crystal material has a positive optical anisotropy and a positive dielectric anisotropy. If the electrodes



5, 6 are energized with an electric voltage, the molecules and hence the directors orient themselves to the field. The cell 1 is bounded by a cell wall or sealing edge 7.

The transparent electrodes 5, 6 of, for example, ITO (indium-tin oxide) which mutually cross each other perpendicularly in this embodiment and define pixels at the area of the crossings must be supplied with drive voltages. These may be applied externally, for example, via conducting tracks 8 on a support 9 such as a printed circuit board. In the device of Fig. 1, the support has an opening 10 in which, if necessary, an illumination source 11 may be arranged.

In the embodiment of Fig. 1, the electrodes 5 are supplied with drive voltages by means of a drive circuit (IC) 12 mounted on the first substrate 3. Contacting of the electrodes 5 (and also the electrodes 6 via methods which are conventional in the LCD technology) takes place via bumps 13. Other bumps 13 contact conductors 14 to be further described. Where in this application a "conductor pattern" on the substrate 3 is referred to, parts or the whole of conductors 14 are meant. In certain cases, the conductors 14 largely also consist of ITO, particularly when there are no ICs on the substrate 3. In other cases (in so-called active matrix LCDs) polysilicon tracks may be part of the conductor pattern.

As stated in the preamble, there is a great need of, for example, LCD screens (in this embodiment the assembly of the substrates 3, 4 with the liquid in between and the conductor tracks and drive circuits arranged on the substrates) to be supplied as one assembly, whereafter the final assembly takes place without any cumbersome steps. However, this should not be at the expense of a satisfactory contact which is necessary between the tracks 8 and the conductor pattern 5, 14.

According to the invention, the display device therefore comprises a metal-metal contact, in this embodiment a gold-gold contact, between a conductor track 14 and a connection pin, in this embodiment a resilient pin 15 (see also Fig. 2). Other suitable metals are silver and nickel.

In the embodiment of Fig. 2, use is made of an anisotropic conductor 14 for the conductor 14, in this embodiment a polyimide copper foil 22, with electrically conducting copper particles 30 which, upon compression, establish an electrically conducting connection between the two surface layers which are gold-plated on their surface (gold layers 24).

The conductor 14 may consist of a small metallized plate. Preferably, the material of this plate is also gold so that a gold-gold contact between the pin part 17 and the conductor 14 is obtained. Such contacts are very low-ohmic and very reliable, so that final assembly of the display device can take place without extra precautions. On the other hand, a

different type of anisotropic conductor with conducting copper tracks 23 transverse to the foil may be used for the conductor 14, which copper tracks extend in one direction, in this embodiment in the direction of the pins 15 to the IC 12. In this embodiment, the foils are gold-plated on both sides throughout their surface so as to prevent oxidation of the copper (gold layers 24).

Since the foils 22 are gold-plated at the location of the contact with the pin 15, the contact between the conductor 13 and the pin 15 has all of the above-mentioned advantages of the gold-gold contact. In this embodiment, the foils are gold-plated on both sides throughout their surface (gold layers 24) so that an extra satisfactory conduction of the conductors 14 is ensured.

A cylindrical housing 16 of the pin 15 incorporates two conducting pin parts 17, 18, in this embodiment of gold, which are interconnected in an electrically conducting and mechanical manner by a resilient part 19 (within the housing 16). In this embodiment, the pin 15 has an electrically conducting surface 20 with the pin part 18 but this is not strictly necessary. The pin part 18 may also have a round or pointed end on the side facing the support 9.

In the final assembly, the assembly of the substrates 3, 4 with the liquid in between and the conductor tracks and drive circuits on the substrates is mounted together with the backlight 11, for example, by a clamping connection 21 or by molding in a plastic envelope under simultaneous pressure.

Since the resilient part 19 is compressed and subsequently the pressure on this resilient part is maintained by the clamp 21 or in a different way, the conductor 8 on the support 9 is connected in an electrically conducting manner to the conductor 14 on the substrate 3 via a pressure contact. Instead of this pogopin, other electrically conducting contact means may be used, such as anisotropically conducting foil contacts.

Fig. 3 shows a variant in which an ITO conductor 5 extends as far as (or proximate to) the edge 27 of the substrate 3. An electrically conducting U-shaped part 25, which is bent around the edge and secured by means of UV glue 26, is now provided between the pin part 17 and the conductor 14. This results in a mechanically tighter construction. The conducting U-shaped part 25 (of a suitable metal such as gold, silver or nickel) may be provided by clamping, for example, by making use of suitable "glued-on pins" which, beyond the conductor part 15, comprise a pin part 29 used for further contacting in other applications. In this embodiment, the parts 29 are cut off after mounting.

Viewed transversely to the drawing, the device of Fig. 3 may also comprise a plurality of such conductor parts 25 which are accommodated in a connector housing. The conductor parts are, for example, punched from a suitable material having a satisfactory electrical conductance such as silver or locally gold-plated phosphor bronze and then molded in a synthetic material housing. The shape and dimension of the conductor parts and the connector housing are preferably chosen to be such that a clamping connection is obtained after the connector housing has been slid around the edge of the substrate 3. Consequently, a satisfactorily electrically conducting contact is obtained between the conductor track (the conductor) 14 and the conductor parts 25. To avoid contact resistances, a conducting paste may be provided, if necessary, at the contact areas between conductor tracks 14 and the conductor parts 25. The electric contact between the conductor part 14 and the conductor 8 may be realized, for example, by a mechanical clamping connection.

In the embodiments hitherto described, the conductor pattern 14 is present on the side of the substrate 3 facing the support 9. The layer 28 denoted by means of broken lines shows that a conductor pattern 28 may be alternatively contacted on the other side of the substrate when using the configuration shown in Fig. 3. In Fig. 1, the conductor 14 is shown as far as beyond the edge 27 of the substrate 3 so as to make clear that also a foil as described with reference to Fig. 2 can be bent around the substrate in order to enhance the mechanical rigidity in a similar manner or, if necessary, to contact conductors on the other surface of the substrate 3.

Fig. 4 shows a variant in which the display device on the substrate 3 has a layer 31 of an electroluminescent material in which poly-LED pixels are defined, for example, by means of the electrodes 5, 6. In this embodiment, the electrode 5 is connected in an electrically conducting manner to the pin part 17 via a small gold-plated plate 14 (or an anisotropic conductor as described above). The other contact of the resilient pin is now constituted by a conducting part 20 contacting the conductor 8 via soldering or by way of the resilient force. The pin 15 is adapted in such a way that the conductor 8 is present on the other side of the support remote from the pixels, but the construction of Fig. 1 is alternatively possible. The arrow 32 represents the light emitted by the poly-LEDs. Since no backlight is necessary in this case, the support 8 may extend under the layer 30 of electroluminescent material where it may comprise, for example, drive electronics (on one side or both sides of the support 9).

The invention is of course not limited to the embodiments shown, but many variations are possible within the scope of the invention. For example, instead of liquid crystal materials, other electro-optical materials such as electrophoretic or electrochromic materials

may be used. The resilient part 19 may also be dispensed with in the resilient pin 15, provided that the distance between the pin parts 17, 18 is sufficiently small to ensure electric contact when the separate parts of the display device are being secured (molded, clicked tight).

In summary, the invention relates to connecting conductor tracks to a support  
5 and conductor tracks to a substrate of a display device via resilient conductors. Notably when using gold-gold contacts, very reliable pressure contacts are obtained.

The invention relates to each and every novel characteristic feature and each and every combination of characteristic features.

## CLAIMS:

1. A display device comprising a first substrate having a conductor pattern for connecting pixels in an electrically conducting manner, parts of which are connected in an electrically conducting manner to connection tracks on a support, characterized in that the conducting connection between at least a part of the conductor pattern and a connection track  
5 comprises a metal-metal contact, in which each metal of the metal-metal contact is chosen from the group of gold, silver and nickel.

2. A display device as claimed in claim 1, characterized in that the metal-metal contact comprises a gold-gold contact.  
10

3. A display device as claimed in claim 1, characterized in that the metal-metal contact is present at the area of the first substrate.

4. A display device as claimed in claim 1, characterized in that the conducting  
15 connection between at least a part of the conductor pattern and a connection track comprises a resilient conductor.

5. A display device as claimed in claim 4, characterized in that the conducting connection between the resilient conductor and the part of the conductor pattern comprises an  
20 anisotropically conducting foil.

6. A display device as claimed in claim 1, characterized in that the conductor pattern is present on the support-facing side of the first substrate.

7. A display device as claimed in claim 1, characterized in that conductors  
25 associated with the conductor pattern extend as far as proximate to an edge of the first substrate, a conductor part associated with the electrically conducting connection between the connection track and the part of the conductor pattern enclosing the edge at the area of said edge.

8. A display device as claimed in claim 1, characterized in that the display device comprises a second substrate and an electro-optical material between the two substrates, each being provided with picture electrodes which define pixels with the interpositioned electro-optical material, the first substrate being provided with the conductor pattern beyond the part of the first substrate located opposite the second substrate.

9. A display device as claimed in claim 1, characterized in that the display device comprises an electroluminescent material.

10. A display device as claimed in claim 1, characterized in that at least a part of the conductor pattern is connected in an electrically conducting manner to a connection track on the side of the support remote from the first substrate.

[illegible]





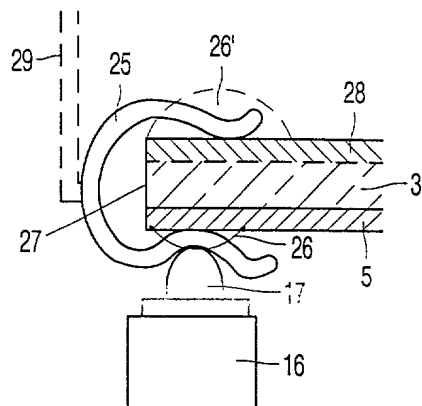


FIG. 3

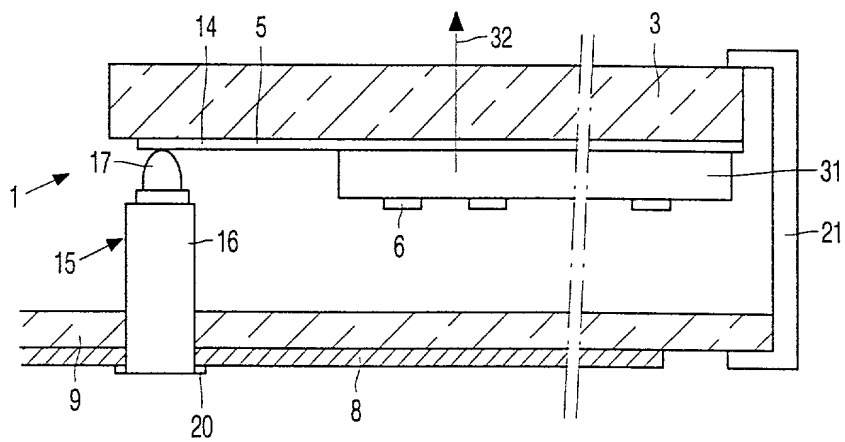


FIG. 4

# DECLARATION and POWER OF ATTORNEY

ATTORNEY'S DOCKET NO.:  
**PHN 17.327 US**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**"Display device"**

the specification of which (check one)

☐ is attached hereto.

☐ was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

**PRIOR FOREIGN APPLICATION(S)**

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	99200696.5	9 March 1999	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

**PRIOR UNITED STATES APPLICATION(S)**

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Algy Tamoshunas, Reg. No. 27,677  
Jack E. Haken, Reg. No. 26,902

SEND CORRESPONDENCE TO: Corporate Patent Counsel; U.S. Philips Corporation; 580 white Plains Road; Tarrytown, NY 10591	DIRECT TELEPHONE CALLS TO: (name and telephone No.) (914) 332-0222
--	--

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Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name	First Name	Middle Name
Residence & Citizenship	City	State of Foreign Country	Country of Citizenship
Post Office Address	Street	City	State of Country
			Zip Code

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

Triepels et al.

PHN 17,327

Serial No.

Filed: Concurrently

Title: Display Device

Commissioner of Patents and Trademarks  
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

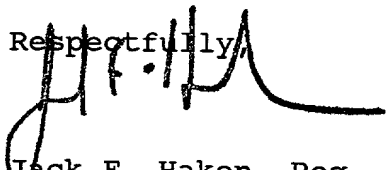
**F. BRICE FALLER**

(Registration No. 29,532)

c/o U.S. PHILIPS CORPORATION, Intellectual Property Department, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,

  
Jack E. Haken, Reg. 26,902  
Attorney of Record

Dated at Tarrytown, New York  
this 22<sup>nd</sup> day of February, 2000.